REPUTATION SYSTEM FOR AN E-COMMERCE SYSTEM USING FUZZY LOGIC

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ABSTRACT

E-commerce system is one of the most rapid-growing systems online. E-commerce system is the medium for buying and selling goods on the internet. However, on internet all the online users cannot recognize each other the way they do in real life. In E-commerce system where transaction is made and money is involved, the reliability of a seller holds a substantial amount of importance. Hence, there are many trust and reputation systems are introduced for e-commerce system. However, many of the existing systems are based on the simple calculation which is vulnerable to user manipulations. This may increase the chances of dishonest rating and reduce the reliability of the reputation system. This project aims to overcome this problem by applying fuzzy logic in the reputation system. By using fuzzy logic to compute a weight based on the user's information, each rating is multiplied with different weight. This can increase the difficulty of manipulation by dishonest users and increase the reliability of the system. The result of applying fuzzy logic shows that it can indeed prevent certain scenarios of dishonest manipulation in user rating.

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ABSTRAK

Sistem e-commerce merupakan salah satu system yang semakin kerap diguna dalam internet. Sistem e-commerce telah menjadi pengantara aktiviti penjualan dan pembelian barangan di internet. Namun, pengguna internet tidak dapat mengecam sesama diri sebagaimana mereka mengenali orang lain di dunia nyata. Dalam sistem e-commerce di mana transaksi berlaku dan wang dilibatkan, kebolehpercayaan seorang penjual memainkan peranan yang amat penting. Justeru itu, sistem amanah dan sistem reputasi telah diperkenalkan dalam sistem e-commerce. Meskipun begitu, banyak sistem reputasi yang ada menggunakan cara kiraan berdasarkan pengiraan mudah yang terdedah kepada manipulasi pengguna. Ini akan meningkatkan kebarangkalian berlakunya rating tak jujur dan seterusnya menurunkan kebolehpercayaan sistem reputasi tersebut. Projek ini bertujuan untuk mengatasi masalah tersebut dengan mengaplikasikan logik fuzzy dalam sistem reputasi. Dengan menggunakan logik fuzzy untuk menghasilkan satu pemberat berdasarkan maklumat pengguna, setiap rating didarabkan dengan pemberat. Ini boleh meningkatkan tahap kesukaran manipulasi oleh pengguna tak jujur dan meningkatkan kebolehpercayaan sistem reputasi. Keputusan aplikasi logik fuzzy menunjukkan sesetengah senario manipulasi tidak jujur dalam rating pengguna boleh dicegah.

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CHAPTER 1

INTRODUCTION

This chapter describes the Reputation System for an e-commerce system using fuzzy logic. This chapter comprises five sections: The first section describes the background of the project. The second section describes the problem statement and motivation of the project. The third section describes the objectives for the project. The fourth section describes the scopes for the project. Finally the thesis organization is described in section five.

1.1 Background

With the explosive growth of the Internet, electronic commerce system is an increasingly important segment of commercial activities on the web. In traditional way, people often do business via face-to-face communication with their personal experience and judgments; while electronic trade cannot support immediate communication. Buyers can only browser some photos and the descriptions from web sites that are provided by sellers. It is hard to decide whether to buy or not. When most of these activities can be made using credit card or other online banking solutions, buyers and sellers do not usually get to meet each other, much less know each other. Now the lacking of trust becomes the bottleneck of E-commerce. In this case, trustworthiness of a seller is the main concern.

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Trust can help people make decisions, while reputation is an expression of trust in social groups. In network community, as the virtual identity of the participants, the traditional trust and reputation systems are unable to build. However, computer network allows users to collects information widely, timely and process information accurately, providing trust and reputation conclusions to users to assist decision making. Reputation system evolves as a mechanism to build trust in virtual world.

In short, reputation system is an important block for achieving trust within large distributed communities, especially when mutually unknown agents engage in transactions.

1.2 Problem Statement

E-commerce system is one of the most widely employed web application in the world nowadays.

However, when a trade involves two people without background information, the issue of sellers' reliability is a main concern. The possibility of fraudulent attempts and scams is a big drawback that challenges an e-commerce system. The number of criticisms about net cheating or mistrust behaviors in electronic trade from customers is increasing, especially in recent years, such as the delivery delay; the quality of commodities that customers brought are bad or is not the same as merchants said in the Internet; many merchants refuse to take the responsibility of the commodities after selling, the after-service is unable to be guaranteed. More and more disharmony phenomenon appears when doing business in the Internet. The main reason is the trust problem.

To cope this problem, there are many reputation is build and apply in e-commerce systems. At present, many C2C E-commerce web sites such as Taobao and eBay have built their own online reputation systems. Unfortunately, these online

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systems often just accumulate the number of three kinds of evaluation feedback, good, medium and bad. These credit evaluation methods are not very reliable and exact.

To improve the simple method of accumulating the number of good, medium and bad, we can reference more reliable and rational methodology to trust evaluation in C2C E-commerce. And more factors associated with trust should be paid attention.

This paper analyzes the criteria of a good reputation system and the existing system. And according to that, a new method is established based on fuzzy logic to provide reliable reputation score. The method involves with the factors that were often ignored before.

1.3 Objectives

The objectives of this project are as below:

i. To create a user reputation system
ii. To apply fuzzy logic in the computation algorithm for the reputation system
iii. To implement the reputation system in an e-commerce system

1.4 Scope

The target users of the Reputation System for an e-commerce system using fuzzy the reputation system is including all registered users with recorded trade history.

1.5 Thesis Organization

This thesis consists of 6 chapters. Chapter one, introduction gives an overview about the system. It consists of five sub topics which are introduction, problem statement, objective, scope, and thesis organization. Chapter two is explaining about the reviews for the system. Other related researches that had been conducted by other will

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be reviewed and explained. Technique or technology that can be used will also be discussed in this chapter. The approach, method used and their justification will be discussed in chapter 3, methodology. There are 4 elements in this chapter, which are introduction, project planning, model usage/ approach and also project requirement. Chapter 4 will discuss detail about implementation. The result and the discussion will be described briefly in chapter 5. This thesis will be ended by the chapter 6, which is conclusion of the whole system.

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CHAPTER 2

LITERATURE REVIEW

This chapter briefly describes the review on existing techniques related with reputation system for e-commerce system. This chapter comprises of two sections: the first section describes the comprehensive review on existing related systems; the second section describes the review on method, equipment, and technology previously used in the same domain.

2.1 Reputation System

2.1.1 What is a Reputation System

On internet, everyone is anonymous to each other and online service provision commonly takes place between parties who have never transacted with each other before, in an environment where the service consumer often has insufficient information about the service provider and about the goods and services offered. This forces the consumer to accept the risk of prior performance. In this case, reputation systems represent a significant trend in decision support for Internet mediated service provision.

According to Wikipedia (2011), a reputation system computes and publishes reputation scores for a set of objects (e.g. service providers, services, goods or entities) within a community or domain, based on a collection of opinions that other entities hold about the objects. The opinions are typically passed as ratings to a reputation center

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which uses a specific reputation algorithm to dynamically compute the reputation scores based on the received ratings.

The basic idea of reputation system is that to solve information asymmetry of provider and consumer. Even if the consumer cannot try the product or service in advance, he can be confident that it will be what he expects as long as he trusts the seller. A trusted seller therefore has a significant advantage in case the product quality cannot be verified in advance (AudunJøsang et.al, 2006).

From the above definition of reputation system, we can conclude that there are two vital elements for a reputation system which are the criteria and the reputation algorithm used to compute the reputation score.

2.1.2 Criteria for a Good Reputation System

This section will discuss about the set of objects mentioned before or in other words, service quality factor. To identify the best set and design a reliable reputation system, criteria for a good reputation system will also be discussed. A few researchers have researched on the critical criteria and their findings are discussed below.

Wang and Huarng (2002) identified nine service quality factors including:

(i) general feedback of the website design,
(ii) competitive price of product,
(iii) merchandise availability,
(iv) merchandise condition,
(v) on time delivery,
(vi) merchandise return policy,
(vii) customer support,
(viii) e-mail confirmation on customer order, and
(ix) promotion activities.

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Besides, e-service quality is also defined as seven dimensions that form two scales: a care e-SQ scale and a recovery scale (Zeithaml, 2002). Core e-SQ consists of four dimensions which are efficiency, reliability, fulfillment and privacy.

Efficiency refers to the ability of the customer to get to the web site, find their desired product and information associates with it and to check it out with minimal effort. Fulfillment incorporates accuracy of the service promises, having products in stock and delivering the product within the promised time. Reliability is associated with the technical functioning of the site, particularly the extent to which it is available and functioning properly. The privacy dimension includes assurances that shopping behaviour data are not shared and the credit card information is securely held.

The recovery- SQ scales includes responsiveness, compensation and contact. Responsiveness measures the ability of a company to provide appropriate information to customers when a problem occurs, a mechanism for handling returns, and an arrangement for online guarantees. Compensation is the dimension that involves receiving money back, return shipping and handling. Contact points to the need of customers to be speak to a live customer service agent online or through the phone.

On the other hand, Allen and Appelcline investigated several reputation systems and summarized six main criteria for a good reputation system.

Firstly, the rating system should be granular. Statistics show that people tend to ignore the lower part of the scale of rating systems. Consequently, the decimal places of mean feedback scores are of decisive importance. The rounding of mean scores or the simplification of ratings to a “thumbs up” or “thumbs down” would be the wrong strategy. For example, a 5-scale rating that allows half-points (e.g. 0.5, 1.0, 1.5, ..., 5.0) gives the user more options for expressing their ratings compared to the one without half-points (e.g. 1, 2, 3, 4, and 5) (Dominikus, Rafael, Fabian, Eelco, Jan, 2011).

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Secondly, the consistent rating performed by the user. If a user expresses the same opinion in two different rating processes with two distinct ratings, the feedback statistic is influenced. For example, we cannot look at two items, see that one is a "2" and another is an "4", and truly believe that the user likes the "4" more than the "2" (Dominikus, Rafael, Fabian, Eelco, Jan, 2011). Therefore, the criteria of the ratings have to be distinct in order to help the users to stay consistent and give more meaningful ratings. The following is an example of distinct rating systems with 5-scale rating for a game (Dominikus, Rafael, Fabian, Eelco, Jan, 2011).

5 – Excellent game. Always want to play.

4 – Good game. I like to play.

3 – Average game, slightly boring, take it or leave it.

2 – Bad game, likely won't play this again although could be convinced.

1 – Extremely annoying game, won't play this ever again

Thirdly, rating systems must be statistically reliable. The best way to realize this is to collect a large number of ratings. If there are only a few unique ratings for an object, the risk of an unreliable overall rating increases. The more ratings are performed for an object, the smaller the effect of outliers (extreme values) is.

Allen and Appelcline also stated that rating systems also should not be bilateral (involving both sides). If users rate each other, there is a high risk that there are almost only positive ratings. The reason for this effect is that users are afraid of getting a negative rating in revenge for a negative feedback.

Fifthly, user ratings should have a concrete usage within a web site. A possible way to achieve this is to display rankings, in which the best and the worst rated users can be investigated.

The last criteria is that a clear user interface is essential for a rating system because badly designed and confusing graphical user interfaces (GUI) discourage users and have a negative effect on the quality of the ratings.

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2.1.3 Computation Technique of Reputation System

As mentioned, a reputation system computes and publishes reputation scores. A computation technique is needed to compute the score. After receiving rating from a rater, the user's current rating score is calculated using certain mathematical formula. Currently, the widely used method is simple summation method. The simplest form of computing reputation scores is simply to sum the number of positive ratings and negative ratings separately, and to keep a total score as the positive score minus the negative score (AudunJøsang, Roslan Ismail, Colin Boyd, 2006). This method is practiced by two major C2C e-commerce site, eBay.com and taobao.com which will be explained in section 2.2.

2.2 Existing Systems

2.2.1 eBay's Feedback System

eBay is a popular auction site that allows sellers to list items for sale, and buyers to bid for those items. The current feedback system used by eBay was created in February 1996 by eBay founder Pierre Omidyar. The Feedback Forum is on open forum for both complaint and praise of members that others have dealt with. When someone purchases or sells an item they can leave feedback for the member they traded with (Joseph, Marie, 2007).

The three ratings that can be left are positive, neutral, and negative. These ratings are then translated into a score for each member. eBay collects all the ratings and computes the scores. The running total reputation score of each participant is the sum of positive ratings (from unique users) minus the sum of negative ratings (from unique users). In order to provide information about a participant's more recent behavior, the total of positive, negative and neutral ratings for the three different time windows i) past

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six months, ii) past month, and iii) past 7 days are also displayed (AudunJosang, Roslan Ismail and Colin Boyd).

Before 2007, eBay's reputation system had a lot of weaknesses. It only supports the three choices of positive, neutral and negative feedback as shown in Figure 2.1 below. There were no clear guidelines to what kind of user behavior should result in which rating and the rating system basically have no use because there is no way to exclude users with a low rating score from auctions (Dominikus Heckmann, Rafael Math, Fabian Abel, Eelco Herder, Jan Hidders, 2011).

There were many empirical studies of eBay's reputation system indicating shortcomings in the old system. In general, the observed ratings on eBay were surprisingly positive. Buyers provide ratings about sellers 51.7% of the time, and sellers provide ratings about buyers 60.6% of the time. Of all ratings provided, less than 1% is negative, less than 0.5% is neutral and about 99% is positive. It was also found that there is a high correlation between buyer and seller ratings, suggesting that there is a degree of reciprocation of positive ratings and retaliation of negative ratings (P. Resnick and R. Zeckhauser). In other words, buyers and sellers tend to help each other by giving positive ratings regardless of quality of the trade.

According to Dominikus, Rafael, Fabian, Eelco, Jan (2011) in May 2007, eBay introduced a new version of rating system. The rating system makes it possible to rate additional aspects of a transaction rather than only providing the three categories positive, neutral and negative. There are now four components in the new rating system which has highly increased the transparency of the auction platform. The four components are:

(i) Was the item delivered as described?
(ii) How was the communication with the seller?
(iii) How long was the shipping time?
(iv) Were the shipping and handling charges satisfactory?

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Using the new five-star rating system, users can give detailed statements within these additional rating dimensions. The mean value of these rating categories is shown in the user profile, among the standard feedback score.

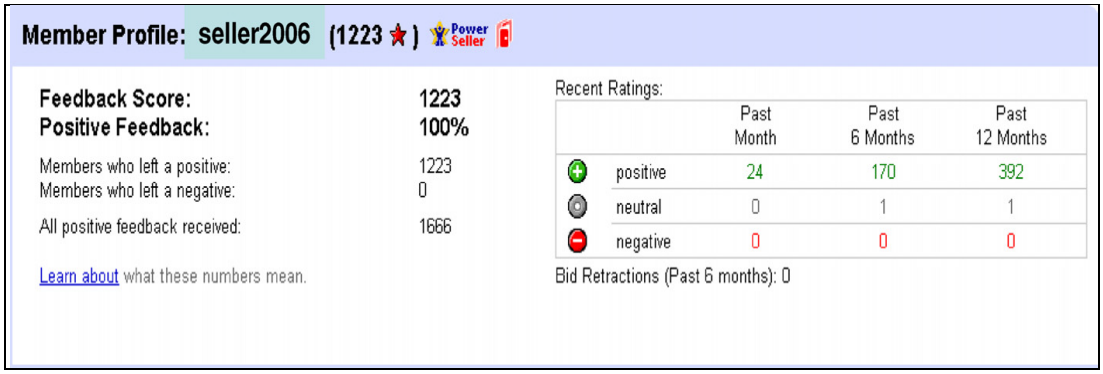

Figure 2.1: eBay's Reputation Forum

(eBay, 1/1/2004)

Figure 2.2: eBay's Member Profile

(eBay, 11/2/2011)

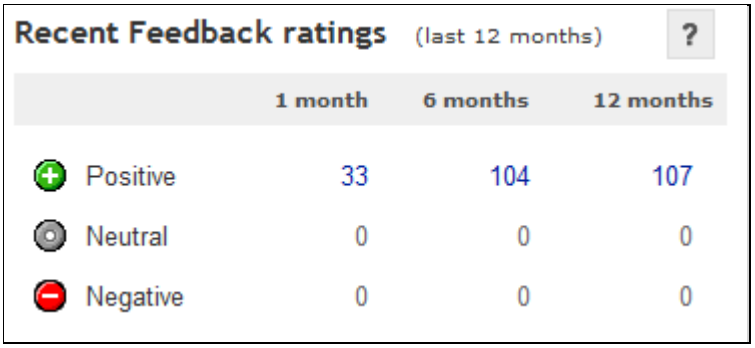

Figure 2.3: Recent Feedback Ratings (eBay, 2011)

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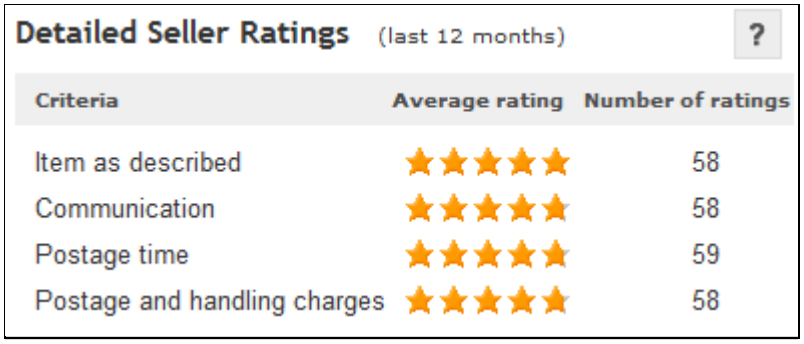

Detailed Seller Ratings (last 12 months) ?

Criteria	Average rating	Number of ratings
Item as described	★★★★★	58
Communication	★★★★★	58
Postage time	★★★★★	59
Postage and handling charges	★★★★★	58

Figure 2.4: Detailed Seller Ratings (eBay, 2011)

Here's what the different stars mean:

Yellow star ( ) = 10 to 49 ratings

Blue star ( ) = 50 to 99 ratings

Turquoise star ( ) = 100 to 499 ratings

Purple star ( ) = 500 to 999 ratings

Red star ( ) = 1,000 to 4,999 ratings

Green star ( ) = 5,000 to 9,999 ratings

Yellow shooting star ( ) = 10,000 to 24,999 ratings

Turquoise shooting star ( ) = 25,000 to 49,999 ratings

Purple shooting star ( ) = 50,000 to 99,999 ratings

Red shooting star ( ) = 100,000 to 499,000 ratings

Green shooting star ( ) = 500,000 to 999,999 ratings

Silver shooting star ( ) = 1,000,000 ratings or more

Figure 2.5: Explanation of Ratings (eBay, 2011)

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Figure	Explanation
Figure 2.1:	Shows the old rating system with only three types of rating, without additional supporting rating aspects.
Figure 2.2: Member Profile	Shows the percentage of positive ratings received in the last 12 months. 1 point is raised or lowered depending on the overall rating from the same buyer within one week. (E.g. Buyer A buy 2 items in same week, Feedback on seller B is raised by 1)
Figure 2.3: Recent Feedback Ratings	Shows the total number of positive, neutral and negative feedback ratings received in the last 1, 6, and 12 month(s).
Figure 2.4: Detailed Seller Ratings	Shows additional rating for this member's performance as a seller. Five stars is the highest rating, and one star is the lowest. These ratings do not count toward the overall Feedback score and they are anonymous. That means that sellers can't trace detailed seller ratings back to the buyer who left them. Detailed seller ratings from the same buyer are counted in the same way as Feedback. Only one every week is included in the seller's score.
Figure 2.5: Explanation of Ratings	Explains the meaning of different 'stars' beside the username on Member's Profile page.

Table 2.1: Explanations of eBay User Rating Pages

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2.2.2 Taobao's Buyer & Seller Creditability System

Taobao.com is one of the largest online shopping websites in China (http://www.taobao.com/about/intro.php). Two major retailing mechanisms exist in Taobao, including Taobao Mall listing brand owners and authorized distributors(Business-to-Consumer, B2C) and Taobao Marketplace where users posts new or used goods for sale. Its online feedback system is similar to the online feedback systems of Amazon and eBay.

Before participating in e-commerce at Taobao, a user's registration needs to pass the Identity Authentication System by providing identity information, including name and contact information. Sellers are required to provide their personal information such as identify number, bank account to the Taobao for approval. Valid email address and payment method are required for buyers. Service Center of national citizen's ID number querying, a department of The Ministry of Public Security, assists Taobaoto check members' registration information, in order to keep away from internet deception.

Buyers and sellers can leave comments about each other after transactions,but this is optional.Each comment consists of one line of text, plus a numeric rating of +1 (positive), 0 (neutral), or -1 (negative). All feedback had to be tied to a transaction: i.e., only the seller and buyer can leave feedback about each otherafter one transaction. Moreover, if some of the buyers forget to give feedbacks, the system will automatically choose "Good". The same way works on sellers.

When posting reviews for a transaction at Taobao, consumers are asked to write a paragraph describing their experiences and rationale for their ratings. Based on the different consumer postings, Taobao gives an average customer rating for each shop. The customer overall ratings of item description, service attitude and delivery speed are averaged and reported in each seller's profile.

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Figure 2.6: Seller's Information (Taobao, 2012)

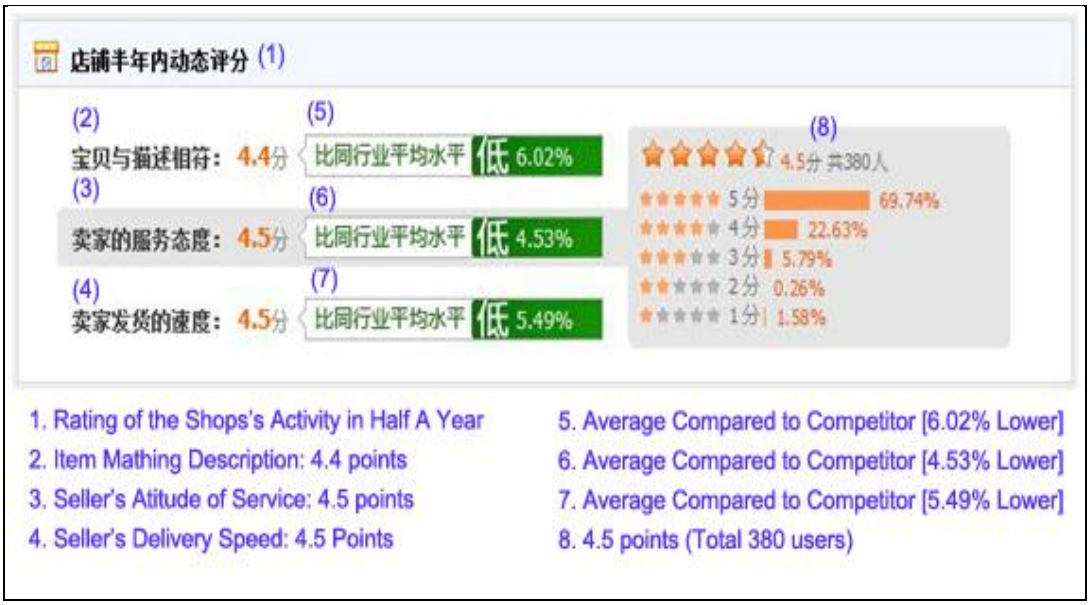

Figure 2.7: Performance of Shop in 6 Months (Taobao, 2012)

Figure 2.7 shows the performance of the shop based on 1. Was the item delivered as described? 2. How would you rate the communication with the seller? 3. How long took the shipping time?

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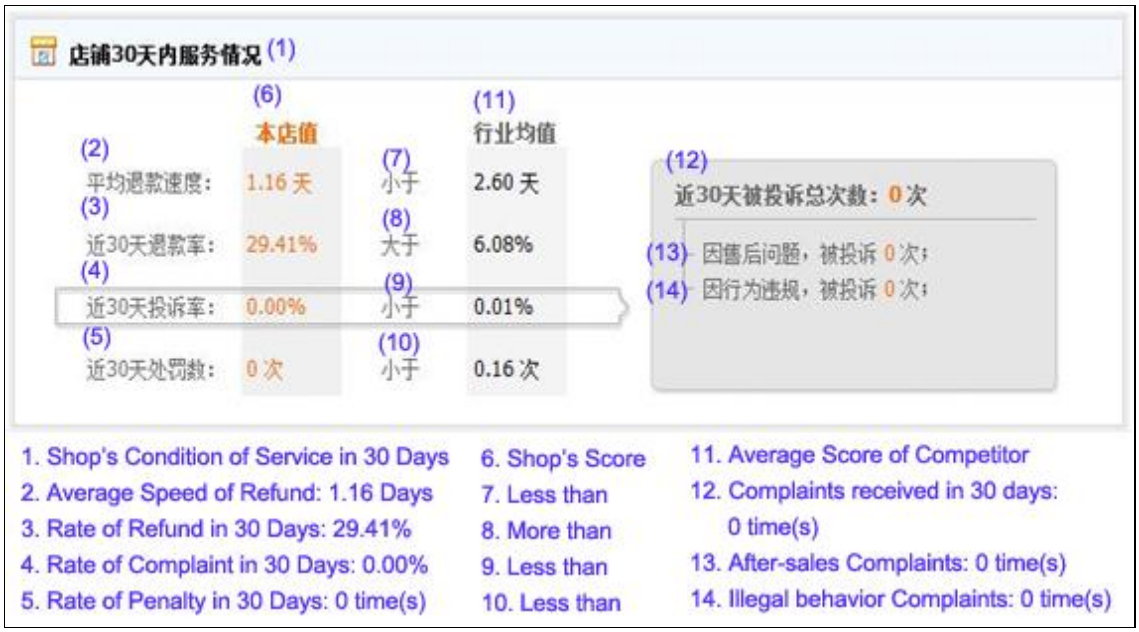

Figure 2.8: Service Condition of Shop in 30 Days (Taobao, 2012)

Figure 2.8 shows the situation of the shop based on 1. Speed of refund 2. Recent 30 days refund rate 3. Recent 30 days complain rate 4. Recent 30 days compound unit.

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